SAIC
Production Software Delivery Risk Management Plan for the
Clouds and the Earth's Radiant Energy System (CERES)
Data Management System

Version 3

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Document Revision Record

The Document Revision Record contains information pertaining to approved document changes. The table lists the Version Number, the date of the last revision, a short description of the revision, and the revised sections. The document authors are listed on the cover.

Document Revision Record

Version Number	Date	Description of Revision	Section(s) Affected
V0	10/12/2005	• Initial version of CERES Risk Management Plan. • Updated format to comply with standards.	All All
V0.1	01/09/2006	• Added Risk Closure Date to Risk Probability column of assessment report. • Added "Example" to table title. • Updated document version number in header. • Updated format to comply with standards.	Table 1-4 Table 1-4 All All
V1	04/04/2006	• Added acknowledgements. • Corrected version numbering for draft versions. • Updated NASA organization information. • Removed acronym definitions from text. • Moved risk identification sections to Section 2. • Modified contents of Risk Identification Table. • Merged mitigation strategy table with Table 2-1. • Added sections describing the generation of the Risk Assessment Report. • Updated format to comply with standards.	Preface Revision Record Cover Page All Sections 1 & 2 Table 2-1 Section 2 Section 3 All
V2	08/04/2006	• Corrected the url in the references. • Updated format to comply with standards.	Reference 2 All
V3	09/15/2006	• Modified the title on the cover page to show association with SAIC instead of NASA. • Modified introduction to identify the existence of the Software Delivery Schedule to associate it with the Risk Management Plan. • Included association with the SAIC Common Approach to Software Development and Maintenance. • Modified Reference 1 (Data Management Plan) to reflect updated titles showing association with SAIC instead of NASA. • Added acronym list.	Cover page Section 1.0 Section 1.0 References Appendix A

Preface

The CERES DMS supports the data processing needs of the CERES Science Team research to increase understanding of the Earth's climate and radiant environment. The CERES DMT works with the CERES Science Team to develop the software necessary to support the science algorithms. This software, being developed to operate at the Langley ASDC, produces an extensive set of science data products. The DMS consists of 12 subsystems, each of which contains one or more PGEs.

This plan's purpose is to provide specific guidance on the management of risks to the development of software that will be delivered to the Langley ASDC. The CERES DMP provides overall guidance on the development of software.

Acknowledgement is given to the SAIC CERES DMT CMMI Team, led by John Robbins, for their input into the contents of this plan. Team members also include Tammy Ayers, Denise Cooper, and Walt Miller. Acknowledgement is also given to Dee Wildman of SAIC's Atlantic Programs Division for her many hours of consultation.

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1.0 Introduction

CERES is a key component of EOS. The CERES instrument provides radiometric measurements of the Earth's atmosphere from three broadband channels: a shortwave channel (0.3 - 5 ∞m), a total channel (0.3 - 200 ∞m), and an infrared window channel (8 - 12 ∞m). The CERES instruments are improved models of the ERBE scanner instruments, which operated from 1984 through 1990 on NASA ERBS and on NOAA operational weather satellites NOAA-9 and NOAA-10. The strategy of flying instruments on Sun-synchronous, polar orbiting satellites, such as NOAA-9 and NOAA-10, simultaneously with instruments on satellites that have precessing orbits in lower inclinations, such as ERBS, was successfully developed in ERBE to reduce time sampling errors. CERES continues that strategy by flying instruments on the polar orbiting EOS platforms simultaneously with an instrument on the TRMM spacecraft, which has an orbital inclination of 35 degrees. In addition, to reduce the uncertainty in data interpretation and to improve the consistency between the cloud parameters and the radiation fields, CERES includes cloud imager data and other atmospheric parameters. The CERES instruments fly on the TRMM spacecraft and on the EOS Terra and Aqua platforms. The TRMM satellite carries one CERES instrument while the EOS satellites carry two CERES instruments, one operating in a fixed azimuth scanning mode and the other operating in a rotating azimuth scanning mode.

The CERES Project management and implementation responsibility is at NASA LaRC. The CERES Science Team is responsible for the instrument design and the derivation and validation of the scientific algorithms used to produce the data products distributed to the atmospheric sciences community. The CERES DMT is responsible for development and maintenance of the software that implements the science team's algorithms used in the production environment. The Langley ASDC is responsible for the production environment, archival and distribution of the CERES data products generated at NASA Langley.

Deliveries of production software to the ASDC are made in accordance to a schedule intended to meet the commitments of the CERES Project to both NASA and the atmospheric sciences community to have specific datasets available within specified time frames. This schedule is defined based on agreements between the CERES Science Team and the DMT software developers. Resources for testing new deliveries and production processing at the ASDC are assigned according to this schedule. The purpose of this document is to define a plan for managing risks associated with the on-time delivery of CERES production software from the CERES DMT to the ASDC operational environment.

This document is prepared in accordance with the SAIC Common Approach to Software Development and Maintenance. Documents describing this approach can be found at https://issaic.saic.com/infocapital/si/pal/casdm/. This document is organized as follows:

Section 1.0 - Introduction
Section 2.0 - Identification of Risks
Section 3.0 - Risk Assessment Report

2.0 Identification of Risks

Deliveries of software to the ASDC for production processing are dependent on multiple resources and functions. Each resource or function on which a delivery is dependent carries some level of risk to a subsystem for meeting scheduled delivery dates. These risks vary throughout the delivery cycle, from delivery to delivery, and from subsystem to subsystem. How a risk is mitigated also varies with each occurrence of a risk and its assessment and for each PGE it affects.

2.1 Risk Categories, Sources, and Mitigation Strategies

Typical risks that may delay a delivery of production software by the CERES DMT and possible mitigation strategies are listed in Table 2-1.

Table 2-1. Typical Risk Identification (1 of 2)

Risk Category	Risk Source	Possible Mitigation Strategies
Input Data	Not available	• Select alternative source • Modify software • Reschedule delivery • Defer to a later delivery
	Corrupted	• Select alternative source • Reorder data • Reschedule delivery • Defer to a later delivery
	Format change	• Modify software • Select alternative source • Reschedule delivery • Defer to a later delivery
Software Development	Science requirements not received	• Select alternative algorithm • Reschedule delivery • Defer to a later delivery
	Contributed software incompatible with existing environment	• Request new version of contributed software • Modify contributed software • Reschedule delivery • Defer to a later delivery
	Required modifications more complicated than anticipated for non-contributed software	• Reschedule delivery • Defer to a later delivery • Engage additional staff
Hardware	Unavailable due to failure, power interruption, or HVAC inadequacies	• Preventative maintenance • Event-driven maintenance • Provide backup power sources
	Lacks capacity	• Upgrade systems to meet demands • Modify job scheduling practices
	Incompatible	• Standardize hardware and software configurations

Table 2-1. Typical Risk Identification (2 of 2)

Risk Category	Risk Source	Possible Mitigation Strategies
	Compromised	• Implement current security measures • Continually monitor for breaches of security • Restrict access • Train staff to follow security practices
Storage	Unavailable	• Event-driven maintenance • Spare disks • Backup system
	Insufficient	• Expand storage • Remove unnecessary files • Share data between subsystems where possible
	Corrupted	• Maintain backup and restoration procedures
Network	Unavailable	• Preventative maintenance • Event-driven maintenance • Provide backup power sources
	Bandwidth limited	• Expand bandwidth • Redistribute processing/data transfer
Software Tools	Unavailable	• Select alternative tool • Reschedule software delivery • Maintain license agreements
	Defects discovered	• Upgrade version • Maintain technical support
	No experience using new or upgraded tool	• Maintain previous version as needed • Pre-implementation testing • Reschedule software delivery • Obtain training
DMT Staffing	Insufficient	• Increase staff • Reassign staff • Reschedule delivery
	Inexperienced	• Reschedule delivery • Replace staff • Incorporate more staff
	Unavailable	• Delay delivery • Replace staff • Incorporate more staff

2.2 Risk Assessment Factors

Risks to the on-time deliveries of software to the ASDC for production processing vary with each delivery. The assessments of the risks also vary during the time between the initiation of requirements and final testing of the software before delivery to the ASDC for production

processing. The same risk may be assessed differently for each PGE it affects. The factors used to evaluate individual risks and their possible assessments are listed in Table 2-2. These assessments are included in the routine Risk Assessment Report described in Section 3.0.

Table 2-2. Risk Factors and Assessments

Risk Factor	Possible Assessments	Assessment Definition
Probability of risk occurrence	Very Low	Probability less than 10%
	Low	Probability between 10 - 25%
	Medium	Probability between 25 - 60%
	High	Probability between 60 - 90%
	Very High	Probability higher than 90%
Impact of risk occurrence on scheduled delivery	Low	Will result in a delay of no more than one week and have no impact on production processing goals
	Moderate	Will result in short delay of delivery but have only a small impact on production processing goals
	Severe	Will result in delay that significantly impacts production processing goals
Resolution Priority	Very Low	No action required for resolution
	Low	Resolve at next convenient opportunity
	Medium	Resolve as soon as reasonably possible
	High	Resolve immediately

3.0 Risk Assessment Report

The Risk Assessment Reports are generated on a routine basis and distributed to the CERES DMT subsystem teams. The intent of these reports is to provide risk-related information regarding scheduled software deliveries that may be communicated to the leadership of the CERES project as necessary. A sample of this report is included in Table 3-1.

3.1 Risk Assessment Report Generation

During routine meetings of the CERES DMT subsystem leads, a designated supervisor determines the risks associated with each delivery listed on the current delivery schedule. The status provided by the subsystem team responsible for each scheduled delivery should indicate whether the delivery is expected to be made on schedule or if rescheduling is necessary. Updates to the assessment of previously identified risks (see Sections 3.1.2 and 3.1.3) and the addition of any new risks (see Section 3.1.1) are communicated at this time. The designated supervisor then generates a current Risk Assessment Report based on the information provided during the routine meeting of the subsystem team leads.

Prior to a critical delivery, risks may need to be assessed on a more frequent basis than the routinely scheduled meetings of the subsystem team leads. Should this be the case, the designated supervisor may obtain the required information through informal interviews with the responsible subsystem team leads.

3.1.1 Including New Risks

Once a risk is identified it is included as a new row in the Risk Assessment Report. An assessment of each risk factor must be included as indicated in Section 2.2. If other risks have already been identified for the same delivery, the row for the new risk is added beneath the existing rows associated with that delivery. All risks for an individual delivery are contained in contiguous rows.

The date of the first Risk Assessment Report for which a particular risk is included is the first information entered for the description of that risk. Once a risk is identified in a routinely generated Risk Assessment Report, it must be included in all future reports until it is no longer considered to be a risk (see Section 3.1.3).

3.1.2 Updating Existing Risks

As stated in Section 2.2, the assessment of each risk may vary from report to report. The information included in an individual Risk Assessment Report reflects the assessment of the risks on the date of the report. It is therefore necessary that the report be generated as soon as possible after the pertinent information is obtained.

Until a risk may be considered closed, the assessment of each risk factor must be included as indicated in Table 2-2. As the strategy for resolving an individual risk may change from report to

report, the date of the Risk Assessment Report for which a given strategy is first indicated is included with the strategy.

3.1.3 Closing Risks

The date of the first Risk Assessment Report for which a particular risk may be considered eliminated is the date indicated for the risk closure. The risk closure date is entered into the column of the Risk Assessment Report that indicates the probability of the risk occurring. At this time the columns indicating the assessment of the remaining risk factors should be blank. The row containing the information for an individual risk may be removed in subsequent reports.

3.2 Risk Assessment Report Distribution and Storage

Each Risk Assessment Report is distributed via email to each member of the CERES subsystem, CM, and Documentation Teams, and each CERES DMT supervisor.

The CERES Documentation Team stores the reports on regularly backed-up workstations in accordance with the CERES documentation configuration management practices (Reference 1). The Documentation Team also posts PDF versions of the reports on a Web site accessible to the CERES DMT subsystem teams (Reference 2).

Table 3-1. Example: CERES DMT Scheduled Deliveries Risk Assessment Report for 02/07/2006[a]

Subsystem	SCCR	Scheduled Delivery Date[b]	Description of Risk (Risk Category)	Probability of Risk Occurrence (Risk Closure Date)	Impact on Scheduled Delivery per Affected PGE	Current Resolution Priority per Affected PGE	Strategy
Inst. SARB	597	01/31/05	11/10/2005 - Risk of IDL not available on ASDC IBM cluster (Software Tools)	(Risk Closed 02/07/2006)			02/07/2006 - Delivered PGE CER5.4P1 expected output for SGI platform only
GGEO	611	02/17/06	11/10/2005 - Risk of not having Final Edition2A March 2003- December 2004 coefficients from Science Team (Software Development)	Low	Moderate	Low	02/07/2006 - Rescheduled to February 17
Inversion		06/16/06	11/16/2005 - Risk algorithms not complete to support Terra/Aqua Beta Edition3 processing (Software Development)	Low	Low	Low	11/16/2005 - Reschedule delivery until algorithms are available 01/10/2006 - Rescheduled to 06/16/06
Inversion		06/16/06	01/10/2006 - Risk of ripple effect of upstream subsystems not ready to produce Edition3 input data (Input Data)	Low	Low	Low	01/10/2006 - Reschedule delivery until upstream processes are ready to produce Edition3 input data

a. The CERES DMT Scheduled Deliveries Risk Assessment Report is an evaluation of possible risks on the day of the report. Evaluations of individual risks change as delivery dates become nearer.
b. Delivery dates are from CERES Delivery Schedule.

References

1. SAIC Data Management Plan for the Clouds and the Earth's Radiant Energy System (CERES) Data Management System, Version 4, September 2006, URL: http://asd-www.larc.nasa.gov/ceres/docs.html

2. On-Line Repository for CERES Pre-DMT Meetings, URL:http://asd-www.larc.nasa.gov/dms/pre_dmt/pre_dmt.html

Appendix A
Acronyms and Symbols

ASDC	Atmospheric Sciences Data Center
CERES	Clouds and the Earth's Radiant Energy System
CM	Configuration Management
DMP	Data Management Plan
DMS	Data Management System
DMT	Data Management Team
EOS	Earth Observing System
ERBE	Earth Radiation Budget Experiment
ERBS	Earth Radiation Budget Satellite
LaRC	Langley Research Center
NASA	National Aeronautics and Space Administration
NOAA	National Oceanic and Atmospheric Administration
PDF	Portable Document Format
PGE	Product Generation Executive
TRMM	Tropical Rainfall Measuring Mission
∝m	micrometers